CLAIMS

1 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" characterized by the fact that it comprises the following sequence of unit operations: ore calcination in fluidized bed or rotary kiln, in the temperature range of 400°C to 550°C, during 30 minutes to one hour, converting hydrated iron oxides into hematite and promoting less needed time for the next reduction step; magnetizing reduction of the calcinated product in fluidized bed or rotary kiln, at 400°C to 550°C, during 5 to 30 minutes, using hydrogen, carbon monoxide, natural gas or any other reducing gas, in order to convert hematite into magnetite; low-intensity magnetic separation of the reduced product, in drum separators, 600 to 800 Gauss magnetic field, extracting the magnetic fraction formed in the reduction stage; dry, high-intensity magnetic separation of the low-intensity non-magnetic fraction, in drum or roll separators and rare-earth permanent magnet, 16000 to 20000 Gauss magnetic field, extracting silicates, secondary phosphates, monazite, calzirtite, zirconolite and uranium and thorium bearing minerals; hydrochloric acid leaching of the high-intensity magnetic fraction, in agitation or column tanks, with 20 to 30% w/w HCl, with 1/2 w/w solid-liquid ratio, temperature between 90°C and 107°C, for 2 to 4 hours, solubilizing primary phosphates, iron oxides, aluminium, magnesium, barium and calcium; filtration of leached product, in belt filter; drying of filtrated product in rotary or fluidized-bed drier; oxidation of dried ore in rotary kiln or fluidized bed reactor, under a flow of air or oxygen, at 1000°C to 1100°C, in the presence of a mixture of sodium fluoride (NaF) and amorphous silica (SiO_2), in a 3% to 10% NaF and 1% to 10% SiO_2 proportion with respect to the amount of material fed to oxidation, forming in the boundary of anatase grains a radionuclide-rich vitreous phase, in addition to promoting radionuclide migration to the iron-rich phase; quenching in water of the oxidation product, respectively stabilizing the vitreous and the iron-rich phases; hydrochloric acid leach of quenched product in agitation or column tanks, with 20 to 30% w/w HCl, with 1/2 w/w solid-liquid ratio, 90°C to 107°C temperature range, during 2 to 4 hours, in the presence of sodium fluoride (NaF) or hydrofluoric acid (HF), solubilizing the radionuclide-rich vitreous phase through the action of generated or added ion

fluoride action (F^-); filtering of second leaching product in belt filter; drying of filtrated product in rotary or fluidized bed drier; dry, high-intensity magnetic separation (16000 to 20000 Gauss) in drum or roll separator and rare-earth permanent magnet, separating the iron containing, radionuclide rich fraction, the non-magnetic fraction becoming the end product and the magnetic fraction being discarded.

2 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" according to claim 1, characterized by the fact that the reduction step is carried out with hydrogen, carbon monoxide, natural gas or any other reducing gas in temperature range of 400°C to 550°C, preferably 500°C, during 5 to 30 minutes, preferably 5 minutes.

3 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" according to claims 1 and 2, characterized by the fact that the separation of impurities rich in iron, silicates, secondary phosphates, monazite, calzirtite, zirconolite and uranium and thorium containing minerals after reduction takes place through the sequential use of operations of low intensity and high intensity magnetic separations.

4 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" according to claim 3, characterized by the fact that the step of high intensity magnetic separation is done in a rare-earth roll or permanent magnet separator, with magnetic field intensity ranging from 16000 to 20000 Gauss, preferably 20000 Gauss.

5 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" according to claims 1, 2, 3 and 4, characterized by the fact that the hydrochloric acid leaching operation after low intensity and high intensity magnetic separations takes place with a solution containing 20% to 30% w/w HCl, preferably 25%, during 2 to 4 hours, preferably 4, temperature between 90°C and 107°C, preferably 105°C, without the addition of air or any other oxidizing agent during leaching.

6 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" according to claims 1, 2, 3, 4 and 5, characterized by the fact that the oxidation step of the product resulting from the first HCl leaching is carried out in rotary horizontal kiln or in fluidized bed, at a temperature between 1000°C and 1100°C, in the presence of a mixture of sodium fluoride (NaF) and amorphous silica (SiO_2), with an amount of 3% to 10% NaF, preferably 6% to 7% NaF and 1% to 10% SiO_2, preferably from 3% to 4% SiO_2, both with respect to the amount of ore fed into oxidation, continuous air or oxygen injection, with a duration of 30 to 120 minutes, preferably 60 minutes.

7 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" according to claim 6, characterized by the fact that the fluoride containing compound used in the oxidation step includes one of more of the following substances: lithium fluoride (LiF), sodium fluoride (NaF), potassium fluoride (KF), magnesium fluoride (MgF_2), calcium fluoride (CaF_2) or ammonium fluoride (NH_4F).

8 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" according to claims 1, 2, 3, 4, 5, 6 and 7, characterized by the fact that the material resulting from the oxidation step is quenched in water, air or any other cooling means.

9 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" according to claims 1, 2, 3, 4, 5, 6, 7 and 8, characterized by the fact that the hydrochloric acid leaching of the product of oxidation and thermal shock is carried out with a solution containing from 20% to 30% w/w HCl, preferably 25%, during 2 to 4 hours, preferably 4, temperature between 90°C and 107°C, preferably 105°C and in the presence of sodium fluoride or hydrofluoric acid, with an amount of 10 g to 30 g of fluoride ion (F^-) per liter of leaching solution, preferably 20 g of F^- per liter.

10 – "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS

FROM ANATASE MECHANICAL CONCENTRATES" according to claim 9, characterized by the fact that the fluoride containing compound used in the second HCl leaching includes one or more of the following substances: lithium fluoride (LiF), sodium fluoride (NaF), potassium fluoride (KF), magnesium fluoride (MgF_2), calcium fluoride (CaF_2) or ammonium fluoride (NH_4F) or hydrofluoric acid (HF).

11 - "A PROCESS TO OBTAIN TITANIUM CONCENTRATES WITH HIGH CONTENTS OF TiO_2 AND LOW CONTENTS OF RADIONUCLIDE ELEMENTS FROM ANATASE MECHANICAL CONCENTRATES" according to claims 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, characterized by the fact that the product resulting from the second hydrochloric acid leaching undergoes magnetic separation through a rare-earth permanent magnet, either roll or drum, with magnetic field intensity ranging from 16000 to 20000 Gauss, preferably 20000 Gauss, the non-magnetic fraction resulting from this separation becoming the final concentrate.